
APPENDIX F.1

Small Mammal and Miscellaneous Taxa Field Survey and Taxonomy Report – 1999 Results

Submitted by Richard Bautz, NHI, December 30, 1999

Introduction

The objective of this survey was to gather baseline data on nonvolant small mammal populations across a variety of natural plant community types in the Lower Wolf River area. The data consists of a direct measure of small mammal biodiversity and relative abundance using standardized and repeatable survey methods.

Methodology

A. Site selection:

Trapping locations were based upon a number of criteria, including habitat fragmentation, area land use, elapsed time since last major disturbance, plant community type, and in some cases, the probability of human vandalism. Site recommendations were provided by Bill Smith – ER/Madison and James Robaidek - Shawano.

B. Equipment and Techniques:

Museum Special snap traps were set out in wandering transects to maximize capture success. Small mammal sign, travel corridors, and micro-habitats were used as indicators of optimum locations for trap placement. The traps were baited with peanut butter and rolled oats and set out in pairs at intervals of about 15 meters. Each site was snap trapped for one night. Pitfall traps were made from either two #10 food cans taped together or 16 oz. plastic cups half-filled with water, and used with a drift fence. Pitfall traps were checked at least once per week until they were picked up.

C. Data management:

All collection locations were noted on USGS topographical maps. Field data and NHI Rare Animal Report forms were created and submitted for incorporation into the NHI Biological Conservation Database. Voucher specimens were kept frozen, and then deposited in the UW Zoology Museum. Photographs were taken at nearly every collection site.

Results

Small mammals of Special Concern and higher conservation status that were collected included 2 Arctic shrews (*Sorex arcticus*) taken at the Rat River State Wildlife Area in shrub-carr. Also collected in the Lower Wolf River Area were 37 white-footed mice (*Peromyscus* spp.), 4 meadow voles (*Microtus pennsylvanicus*), 9 meadow jumping mice (*Zapus hudsoni*), 2 red-backed voles (*Clethrionomys gapperi*), 4 masked shrews (*Sorex cinereus*), 4 short-tail shrews (*Blarina brevicauda*), 4 thirteen line ground squirrels (*Spermophilus tridecemlineatus*), and 1 cottontail rabbit (*Sylvilagus floridanus*). A total of 14 sites were surveyed - Museum Specials were used for 450 trapnights, and pitfall traps were used for 128 trapnights. This represents an average capture success rate of 11.6% for both traps.

Discussion

The significance of finding, or not finding expected species at a given location provides useful information to resource managers and planners. The need to collect accurate data across a very large landscape efficiently requires the ability to make rapid assessments in site selections, and then follow up with captures that reflects the species diversity at those sites. Voucher specimens complete the record, and provide verifiable data for current and future use.

Two Arctic shrews taken at the Rat River State Wildlife Area. They were the only species of Special Concern conservation status captured. This is rather important because the shrub-carr habitat, and its proximity to water strongly suggested the presence of this species. My impression was that the location of this occurrence has remained relatively undisturbed for a rather long period of time. I have captured Arctic shrews in several places around the state, all either in or near shrub-carr within close proximity to water. Other *Sorex* species were noticeably absent.

Finding relatively undisturbed study sites was difficult. The Lower Wolf River Area is quite large and dominated by human land uses such as agriculture, logging, wetland manipulation, and home/cottage development. Despite the overall acreage of the area, the southern part of the basin contains a great deal of their own type of "sameness" throughout. These lands also receive intense recreational use.

Many sites were investigated, but selection of collection sites was usually based upon finding the better of sub-optimal habitats. To a degree, the White-footed mouse or *Peromyscus* may be thought of as a pioneer species, it is typically the first species of small mammal to traverse and eventually colonize disturbed forest landscapes. Years of targeting *Peromyscus* for tick/Lyme disease research has acquainted me with habitat situations that hold *Peromyscus* populations at very high levels. Much of the Lower Wolf River area resembles ideal *Peromyscus* habitat. The challenge was to sample a site for small mammal species richness without having the ubiquitous *Peromyscus* fill all the traps. To compensate for this, greater numbers of traps were used in the transects.

One unusual observation was the low number of *Sorex* species (shrews) captured at the Lower Wolf River Area. As a double check of equipment and techniques, several sites were surveyed in southern Wisconsin (Scuppernon Prairie / Waukesha Co., Hogback Prairie / Crawford Co., Eagle Valley / Grant Co., etc. on my own time), and *Sorex* species were systematically collected.

If a site is trapped and a *Sorex* is not captured it could simply mean that they are difficult to catch (they are), but to trap many sites across a large scale area and find them almost totally absent, likely reflects wide spread and persistent negative alteration of the landscape. In times of drought, *Sorex* species become more restricted to the habitats close to water, but this was not the case in the Lower Wolf areas sampled.

In summary, the conservation status of small mammal populations in the 1999 study areas is presently best understood as the apparent result of ecological simplification and habitat fragmentation. Survey time and efforts were inadequate to ascertain a full understanding of the presence and distribution of small mammals, and additional work in the basin is recommended for next year.

APPENDIX F.2

Small Mammal and Miscellaneous Taxa Field Survey and Taxonomy Report – 2000 Results

Submitted by Richard Bautz, NHI, 2000

Introduction;

The purpose of this survey is to gather baseline data on nonvolant small mammal populations across a variety of geographic and natural plant community types in the Upper Wolf River area. The data consists of a direct measure of small mammal biodiversity and relative abundance using standardized and repeatable survey methods. Due to a limited time frame, only high quality sites were surveyed.

The capture of an arctic shrew (*Sorex arcticus*) at the Norrie Lake Wetland bog suggests a minimally disturbed area. The arctic shrew has a State Element Rank of S2

A population of pine voles (*Microtus pinetorum*) was discovered at the Wolf River Oxbow “Bear caves” area. Pine voles are ranked as S1 in Wisconsin. The pine vole is the second rarest* small mammal in Wisconsin. This very unique find is a new county record and the most northern occurrence of this species in the state.

*The only report of Wisconsin’s rarest small mammal, the least shrew (*Cryptotis parva*), is over fifty years old, and is based solely upon two skulls found in owl pellets. (1961. Jackson.). No one has ever trapped a least shrew in Wisconsin.

Background

There are no records of previous small mammal investigations in any of the sites surveyed.

Methods

Trapping locations were based upon a number of criteria, including access, the natural plant community type, size and age structure, area land use, and unique geographical features. Site recommendations were provided by Emmet Judziewicz, Eric Epstein, and Elizabeth Spencer.

Museum Special, regular snap traps and rat traps were set out in wandering transects to maximize capture success. Small mammal sign, travel corridors, and microhabitats were used as indicators of optimum locations for trap placement. The traps were baited with peanut butter and rolled oats and set out in pairs at intervals of about 15 meters. Each site was trapped for one night. GPS coordinates were taken at all collection locations as well as being noted on USGS topographical maps. Field data forms were created and used together with the Heritage Rare Animal Report forms. Voucher specimens were kept frozen, then deposited in the UW Zoology Museum. Photographs were taken at every collection site.

Results

Small mammals of significant conservation interest include 7 pine voles taken at the Wolf River Oxbow area. The pine vole’s State Element Rank is S1. An arctic shrew (S2) was taken at the Norrie Lake Wetland bog.

Also collected in the Upper Wolf River area were 29 white-footed mice (*Peromyscus* spp.), 2 masked shrews (*Sorex cinereus*), 19 short-tail shrews (*Blarina brevicauda*), and one southern flying squirrel (*Glaucomys volans*). The combined results are: 59 small mammals captured in 300 trapnights. This represents a capture rate of 19.66 %.

Discussion

The rapid assessment survey method for small mammals I have developed over the years was rewarded by the capture of seven pine voles at the Wolf River Oxbow area. This is a very significant find. First, because this small mammal has been rarely collected in Wisconsin. Second, because of this vole's semifossorial live style which makes it characteristically difficult to capture even in southern states where it is common. The trap line through the Oxbow area was purposely long, and trapping success brings up a number of concerns: the pine vole is not ubiquitous in the area. Captures were restricted to in or near the talus slopes. The limited range they occupy also suggests this animal's inability to recover from previous large scale changes in land use (i.e. logging). This animal shuns areas of open or no forest canopy cover, and soil compaction (tire tracks) which greatly restricts its typical below ground foraging habits. The talus slopes provided a safe haven, but dispersion into the surrounding now suitable habitat has apparently not occurred. Very similar habitats at the Boy Scout Camp (sites 00BAU043 and 00BAU046) were also surveyed, but pine voles were not found. Because of this species small home range (15-30m / 50-100 ft.), short life span (ave. less than 3 months) and rarity in Wisconsin, efforts should be made to map its distribution, determine population viability, and investigate the effects of forest management in order to better insure its protection.

It is a bit difficult to quantify arctic shrew habitat. I have collected them in many sites ranging from marsh edges and tamarack bogs to red pine uplands. All sites had a few things in common, an adequate duff layer of grass / sedge, or coarse woody debris for protection from predators, and a lack of disturbance for a relatively long period of time.

The arctic shrew from the Norrie Lake Wetland was captured in the open bog area. It was about 150 meters from a large tamarack area, this suggests the fall dispersal from the more "preferred" tamarack habitat. Permission to trap the tamarack woods had not been granted. Other small mammals of important conservation status that may occupy this apparent high quality wetland include pygmy shrews (*Sorex hoyi*), water shrews (*Sorex palustris*), and southern bog lemmings (*Synaptomys cooperi*).

Another possible small mammal species that could exist in the extensive talus areas found near the Upper Wolf River is the rock vole (*Microtus chrotorrhinus*). This species has never been collected in Wisconsin, but it is found along the western shore of Lake Superior, eastward across Canada and down through the Appalachian Mountains. It is quite possible that the rock vole has remained undetected in Wisconsin.

References:

- Jackson, Hartley H.T. 1961. Mammals of Wisconsin. The University of Wisconsin Press. Madison, WI.
- Kurta, Allen. 1995. Mammals of the Great Lakes Region. The University of Michigan Press. Ann Arbor, MI.

APPENDIX G

Terrestrial Invertebrate Survey Report - 1999 Results

Submitted by Kathy Kirk, NHI, January 13, 2000

Introduction

This survey was a preliminary study to gather information on the availability of habitats for terrestrial invertebrates, particularly those currently listed as threatened, endangered, or special concern in the state (WNHI, 03/17/99). A limited amount of species-specific research was undertaken. The work focused on identification of areas (1) likely to support faunal diversity (2) habitat for species on the NHI working list (3) good examples of natural communities for diversity sampling sites.

Sites

The 1999 fieldwork was restricted to a number of sites in the lower Wolf River Basin. Attempts were made to visit each of the state wildlife areas with appropriate terrestrial habitat. Sites were selected based on consultation with ecologists and wildlife managers familiar with the sites. Although much wetland habitat is present in the area, these sites were not visited during 1999. Although some of the following sites were visited, no data was collected at the following state lands because they have limited terrestrial habitat:

- Wolf River Wildlife Area: The upland area occurs only near a house on the property and has been under agriculture for many years. Two visits to the area were made to the large area with the conclusion that the Wolf River W.A. is heavily diked and indeed, nearly completely wet. Some wet and wet-mesic forest invertebrate potential is present.
- Hortonville Bog State Natural Area: No visits. Wet, bog site. Potential for bog lepidoptera.
- Maine Wildlife Area: One visit to search for entry. Wet, bog site. Potential for bog lepidoptera.
- Mukwa Wildlife Area: No visits. Primarily aquatic communities.
- LaSage Unit: One visit. Good quality wet to wet-mesic forest habitat and river edge.

Data was collected at the following sites (site map numbers follow):

Site	Site Number
• Koepke County Park	KK01
• Mack Wildlife Area	KK02
• D.O.T. Mitigation Site	KK03
• Outagamie Wildlife Area	KK04
• Navarino Wildlife Area	KK05, KK07, KK08, KK13, KK14, KK15, KK19
• Rat River Wildlife Area	KK06, KK12, KK16
• Winnebago Co. Trail	KK11
• Deer Creek Wildlife Area	KK18, KK20

One early season visit was made to each of these sites:

- Tellock's Hill Woods SNA Waupaca County
- Jung Hemlock Beech Forest SNA Shawano County

Methodology

The early season visits occurred on May 9, 1999. The rest of the fieldwork was conducted over 8 days, primarily in June, with one visit in mid July and another in late August. During this period, 20 sites were visited and data collected from 18 sites. Insects were observed and data collected using a number of techniques including hand collection, photography, aerial net, sweepnet, pitfall trapping, funnel trapping, and black light trapping.

Sweepnetting for leafhoppers and other vegetation inhabitants was conducted in grassland areas and, at one site, along the edge of the Wolf River. Pitfall traps to sample the ground-dwelling invertebrates were used at grassland sites, woodland sites, and wetland edges. Funnel trapping was used at one site to capture wood boring beetles and cohorts on pine. Blacklight trapping was conducted at two sites for night-flying insects attracted to light.

Site	Collection Method
Koepke County Park	Hand
Mack Wildlife Area	Sweep
D.O.T. Mitigation Site	Pitfall
Outagamie Wildlife Area	Sweep, Pitfall
Navarino Wildlife Area	Sweep, Pitfall, Blacklgt, Funnel, Hand
Rat River Wildlife Area	Hand, Sweep
Winnebago Co. Trail	Hand
Deer Creek Wildlife Area	Hand, Sweep
Tellock's Hill Woods SNA	Photo
Jung Hemlock Beech Forest SNA	Photo, Hand

Specimen Handling

Invertebrate specimens were placed in 70% ethyl alcohol. In the laboratory, collections were sorted taxonomically. Hard-bodied Coleoptera, Orthoptera, Heteroptera, ants, large wasps and adults of Lepidoptera and Neuroptera were pinned and dried. Minute and soft-bodied insects, Diptera, Arachnida, Diplopoda, Chilopoda, and aquatic macroinvertebrate specimens were retained in alcohol vials. A total of 841 specimens were collected.

Taxonomy

The author of this report made taxonomic determinations to species for butterflies, Orthoptera, tiger beetles and a few other Coleoptera families, and some ants. Leafhoppers were determined where possible by staff of the DNR-Research Prairie Invertebrate Study. Others have been sent to Andrew Hamilton of Agriculture Canada for species determinations. Spiders have been sent to Frank Pascoe, University of St. Francis, Joliet, IL, for determination of Salticids and sorting to family of other groups. Beetles of the family Tenebrionidae, Scarabiidae, and Cantharidae have been sent to specialists at the Entomology Dept., UW-Madison. Aquatic macroinvertebrates were sent to Kurt Schmude, UW-Superior. Two hundred specimens have been identified to species, 52 to genus, 56 to subfamily and 332 to family level. The remaining specimens of the orders of Neuroptera, Diptera, Thysanoptera, Ephemeroptera, Hymenoptera other than Formicidae, as well as the non-insect arthropods have been retained in alcohol for future sorting and determinations. Preliminary species lists for butterflies and grasshoppers are attached to this report.

Data Handling

Data on all specimens collected were entered into Paradox database files. Rare taxa were documented on NHI Element Occurrence Forms and entered into the Biological Conservation Database (BCD).

Results

The early season visits were timed to search for the West Virginia White butterfly in high quality mesic forest within the study area. Neither the butterfly nor its host plant, toothwort, *Dentaria sp.*, were found at the site although the darkly-veined spring morph of the more common mustard white butterflies were present.

The grassland areas at Navarino Wildlife Area were found to contain some prairie elements but dominated by grasses and common forbs, offering minimal variation in structure and plant community needed to support insect diversity or prairie specialists.

Management history is valuable information to determine the potential habitat for insects in grasslands as well as the effects of management activities on the plants and animals present. Management activities at each site should be recorded annually.

Grassland areas that merge into sedge meadow appear to support the greatest diversity in Homoptera, Heteroptera, and other insects including Coleoptera families that inhabit vegetation as recorded by the limited surveys of the 1999 season (KK06, KK12 at Rat River and KK14 at Navarino). At the other ecological extreme, the area at Navarino on Hwy K with large sandblows (KK15) is valuable habitat for grasshoppers, antlions, tiger beetles, and other open sand inhabiting insects. The barrens habitat at KK08, as a continuation of the band of exposed sand habitat at Navarino, is similar in this regard but appears to support less diversity of the ammophilous or sand-loving community of species, perhaps as a result of size, proximity to the highway, and more canopy cover.

Deer Creek near the northern parking lot (KK18) has open sand habitat, perhaps anthropogenic. Along the northern border of Deer Creek are sandy areas said to have been planted with prairie species 12 years ago. The areas, however, are growing in and offer less habitat for the ammophilous insect community than the parking lot area.

The Rat River site along Shady Lane (KK12) is notable for the diversity of habitat available, both wet and dry, including open ground along the entrance road. Bottlebrush grass, *Elymus hystrix*, a savanna indicator, was observed near the woods edge. Many butterflies were observed using the habitat between the woodland edge and the wetland edge. Swamp milkweed and goldenrods were prominent, but so also was extensive, non-native brome grass.

The Winnebago County Trail (KK11) held little habitat for terrestrial invertebrates but harbors extensive knapweed and sweet clover along the edges of the trail.

The Wolf River Wildlife Area (KK10) has some purple loosestrife at the end of the road that goes through the community of cabins.

The LaSage Unit (KK17) is an excellent example of unmanipulated bottomland forest with a diverse canopy of hackberry, basswood, walnut, and maple; good groundflora including lady's thumb and cardinal flower; and lots of lianas near the river edge. Only a small stand of reed canary grass was observed at this site.

Element Occurrences from preliminary fieldwork:

The following are elements on the current NHI working list that were recorded from 1999 fieldwork.

- *Euphyes dion* Dion Skipper Site KK02 Mack W.A. June 29
1 specimen at DNR Research
- *Trachyrhachis kiowa* Ash-brown Grasshopper Site KK18 August 26
1 male specimen at DNR Research
- *Spharagemon marmorata* Northern Marbled Locust Site KK15 August 26
1 female, 2 male specimens at DNR Research

New County Records for Shawano County*:

The following are new county records for Shawano County. Neither species is on the current NHI working list.
Scarabaeidae Scarab Beetles

- *Macrodactylus subspinosus* This is the “rose chafer” of the scarab beetle group that feeds on plants. It was quite abundant on flowers in June at several sites (KK13, KK14, KK15 at Navarino).
- *Melanocanthon nigricornis* and *Onthophagus nuchicornis* These are dung beetles that were collected in the pitfall traps at the Navarino prairie site KK13.

Additional animal observations of interest:

- Cuckoo nesting at Outagamie Wildlife Area (KK04).
- Bobolinks at Rat River Wildlife Area (KK06).
- Clay-colored sparrows at Rat River Wildlife Area (KK12).
- Yellow-headed blackbirds and black terns at DOT Mitigation Site (KK03).
- Golden-winged warbler at Navarino Wildlife Area (KK07).

Report submitted January 13, 2000

*Note: Nadine Kriska, a beetle specialist at the University of Wisconsin-Madison is at work on the Scarabaeidae of Wisconsin and has studied insect collections, literature, and other specialists to produce a list of species and records of collection by county. Relatively few other insect families have been well studied or surveyed in the state to offer biologists a similar perspective.

APPENDIX H

Herpetological Survey Of The Wolf River Geographic Management Unit With Emphasis On Rare Species

Submitted by Erik R. Wild, PhD, University of Wisconsin-Stevens Point, March 3, 2001

Introduction

This report is provided as part of the contractual agreement (Research Contracts NMJ00001783 and NMA00000022) with the Wisconsin Department of Natural Resources (WDNR) to perform the research project “Rare Herp Biotic Field Surveys: Flambeau River State Forest and Wolf River Geographic Management Unit (GMU)”. Reported herein are the results of the Wolf River GMU portion of this research project. The complete Problem Statement and Project Objectives can be found in the proposal for this project (13 April, 2000). In short, the objective of the project is to obtain data on the herpetofauna of the Wolf River GMU, with particular focus on rare species. Rare species herein refers to those listed by the WDNR as Endangered, Threatened, or Special Concern, plus others identified by Wisconsin’s Natural Heritage Inventory Program (NHI) Working List. Accordingly, there are two Endangered (*Acris crepitans*, *Ophisaurus attenuatus*) and two Threatened (*Clemmys insculpta*, *Emydoidea blandingii*) Wisconsin herps that have the potential of occurring in the Wolf River GMU, whereas four Special Concern (*Hemidactylium scutatum*, *Rana catesbeiana*, *Diadophis punctatus*, *Coluber constrictor*) species can be expected.

Methods

Fieldwork in the Wolf River GMU took place during 5 June – 17 July, 2000 involving five researchers (Erik R. Wild, P.I.; Joel A. Ernst, Graduate Assistant; Pam D. Widder, Intern; Darcy R. Robison and Neal Halstead, Volunteers). Twenty-five field visits were made on twenty-three different days for a total of 282 person hours in the field.

Site Selection

Sites were visited throughout the Wolf River GMU and in a variety of habitats, however, emphasis was placed on obtaining records for Endangered, Threatened, and Special Concern species, especially the Threatened *Clemmys insculpta* and *Emydoidea blandingii*, and the Special Concern *Hemidactylium scutatum*. Sites were selected using the interim reports of the Wolf River Experts Workshop and NHI Coarse Filter Screening (Biotic Inventory & Analysis of the Wolf River Basin, 2000*Draft*), plus NHI Program Element Occurrence Records. Of these, public lands including state wildlife and natural areas were emphasized as were the Wolf River, Little Wolf River, and select tributaries. Searches were performed and data gathered on other species of the herpetofauna when visiting these sites. Other additional localities were visited opportunistically

Fourteen Experts Workshop Sites, 20 NHI Program Element Occurrence Records Sites were visited encompassing many of the Coarse Filter Screening Sites. Approximately 20 miles of the Wolf River, ~8 miles of the Little Wolf River, and several tributaries were waded, canoed, or examined from shore for some portion of their length. A total of 46 specific localities were recorded, including observations of live or road-kill specimens, actual and potential nesting areas, and habitat with high potential for herp occurrences ([Appendix I](#)).

Survey Techniques

Due to limited time and the large area to be surveyed, the majority of fieldwork involved active searches with hand capture or road-cruising. Furthermore, as there was limited previous herpetological work in the Wolf River GMU, efforts were also made to visit sites of previous records, and identify new potentially valuable sites and habitats. As an effort to standardized the field work for site-to-site and year-to-year comparisons, survey effort was measured in person hours as is standard for surveys of organisms as diverse as reptiles and amphibians. Active searches primarily involved flipping rocks, logs, and debris on land; wading and using dip-nets and binoculars in waterways, and digging by-hand through moss and rotting logs in bogs. Road-cruising involved travel from site-to-site and exploration for appropriate habitat. This report should not be considered a comprehensive survey of the Wolf River GMU, nor is it a thorough sample of the area. Furthermore, no effort was made to perform equivalent sampling among ecological landscapes.

Specimen Data

All observations and specimens were recorded following, but not limited to, the methods of the Wisconsin Herp Atlas Project (Casper, 1999). Select specimens were measured, weighed, sexed, and photographed before release. For all observations, localities were recorded with township, range, and section from DeLorme Gazetteer, and latitude and longitude from a Garmin or a Magellan Map 410 GPS unit (waypoints taken with Garmin remain in its memory). Salvaged road-kill and select live specimens were taken as vouchers, photographed, fixed in 10% buffered formalin, preserved in 50% isopropyl alcohol, and deposited in the Herpetology Collection of the Museum of Natural History & Department of Biology, UWSP ([Appendix II](#)). Rare Animal Report forms were completed for any threatened, endangered, or special concern species, and for any new distribution records ([Appendix III](#)).

Results

Sites

A total of 46 specific localities were recorded for various reasons, including observations of live or road-kill specimens, actual and potential nesting areas, and habitat with high potential for herp occurrences. The complete data (date, time, latitude / longitude, township-range-section, county, locality description, significance, taxa present, and voucher material) for these sites are provided in the Site Spreadsheet ([Appendix I](#)). The sites include one locality for the Endangered *Acris crepitans*, thirteen observations of the Threatened *Emydoidea blandingii*, and two observations of the Special Concern *Hemidactylium scutatum*. One new county record is reported with *Lampropeltis triangulum* from Portage County.

Experts Workshop Sites with High Potential for Conservation and Inventory

The following sites were recognized as high potential for conservation and inventory by the NHI Experts Workshop. Effort was made to visit as many of these sites as possible to at least assess the potential for harboring rare herps. However, difficulties were encountered in obtaining access to some of the sites that were surrounded by private lands. Since there were numerous public access sites to survey as well, these were emphasized, and when difficulty was encountered obtaining landowner permission at the land-locked sites, these were abandoned. Several of these sites should be surveyed in the future. Most visits were too brief to adequately sample the herpetofauna. Herps that were encountered are reported, and the potential for rare species is discussed.

BAKER LAKE (NEH 11): Access to this lake was not acquired, but driving by indicated high potential for *Emydoidea blandingii*. This small, clear water lake had numerous downed limbs suitable for basking. Permission should be acquired and the lake thoroughly surveyed.

DALE ROAD WOODS (NEP 11): This site was visited once (1.75 person hours) producing *Rana pipiens* and *Chrysemys picta*.

EMMONS CREEK AREA (CSH 03): This site was visited four times (4.5 person hours). Only *Rana clamitans* was encountered at the edge of a small pond near the creek. In spite of the lack of productivity, this site holds great potential. The area is diverse with open sandy xeric areas, pronounced forested topography, and a high quality, fast flowing clear-water stream. This site holds high potential for *Clemmys insculpta*, and future surveys should work the stream by foot searching for these turtles.

FLYNN LAKE BOG (NEP 04): Attempts were made to visit this bog, but access permission could not be obtained.

HORTONVILLE BOG (NEP 08): This site was visited once (3 person hours) and in spite of intense effort, no herp species were found. This isolated sphagnum bog is very secluded and holds high potential for *Hemidactylum scutatum*. It was surprising that none were found, nor were any *Plethodon cinereus*, *Ambystoma laterales*, or *Rana sylvatica*, all species for which this bog is ideal habitat. Additional survey work should target this site because if a population of *Hemidactylum* does exist there, it is isolated and vulnerable.

MAINE STATE WILDLIFE AREA (NEP 03): This site was visited once (3 person hours). *Ambystoma laterale*, *Plethodon cinereus*, and *Hyla versicolor/chrysoscelis* were all documented. The area is isolated in the center of open agriculture, and shows evidence of past manipulation including ditches. A large portion of the wetland area was explored. The habitat is not suitable for *Clemmys* because there is no flowing water. *Emydoidea* could occur there, but this seems unlikely because no deeper, open bodies of water were found. No sphagnum bogs were found, but shallow puddles with other mosses were found in some forested areas. Nonetheless, it is unlikely that *Hemidactylum* occur there. This site could benefit from additional work, but it is low priority for the rare species considered herein.

MATTOON SWAMP (NEH 10): Access to this swamp was not acquired.

MOSQUITO HILL STATE WILDLIFE AREA AND NATURE CENTER (NEP 09): This site was worked thoroughly during a single visit (4 person hours). The site exhibits a variety of habitats from lowland riparian forest, to upland forest, plus open meadows and oxbow lakes and ponds. The entire river frontage was walked, and although numerous basking logs were present, no turtles were seen. The bank has extensive stretches of rip-rap in this area. The site holds great promise for *Emydoidea blandingii*, and in fact, a resident naturalist reported seeing them on the property in the past. This site should be worked more thoroughly in the future to confirm the presence of *E. blandingii* and assess the population status. Other herp species observed include: *Chrysemys picta*, *Rana clamitans*, *Rana sylvatica*, *Ambystoma laterale*, and *Thamnophis sirtalis*.

MUD LAKE FOREST HEADWATERS (NEH 16): This site is an undisturbed bog-lake with surrounding upland forest. The site was visited twice (4 person hours). Considerable effort was made to work sphagnum for *Hemidactylum*. Although none were found the site holds high potential because it is relatively undisturbed, has extensive floating sphagnum and other mosses in the low forest adjacent to the bog. It is likely that *Emydoidea* also inhabit the lake, although none were seen. Other herps observed include: *Chrysemys picta*, *Bufo americanus*, *Rana sylvatica*, *Plethodon cinereus* (UWSP 3820-21), and *Ambystoma laterale* (UWSP 3822).

NAVARINO STATE WILDLIFE AREA (NEP 01): This large wildlife area was worked intensively. It was visited on four separate occasions (25 person hours). Two of these occasions salvaged road-kill *Emydoidea blandingii* on Cty K passing through the western edge of the area (Herp 77, 82; UWSP 3802, 3810). These two sites were separated by approximately 10 meters and the road-kills by two days. It seems that Cty K was being used as a detour for Hwy 22 and that there was more semi-traffic than typical. Furthermore this local was just south of a bend in the road so that traffic could not see turtles ahead and Cty K lacks any shoulder space at all. All of these factors combined give a driver little opportunity of avoiding turtles. It is hoped that this problem is temporary because it appears the road is heavily traversed by these turtles. The site should be monitored into the future to assess the degree of mortality. Other *Emydoidea* were seen within the NSWA as well (Herp 83). There appears to be a healthy population of *E. blandingii* in the NSWA.

Other areas explored include the trail that passes Loop and Pikes Peak Flowages, Waltrach Flowage and drainage, and McDonald Flowage. Numerous predated turtle nests were found along the dike of Waltrach Flowage. A small stream (Herp 85) was worked on the east side of NSWA, just west of White Lake. This slower moving, muck bottomed stream was well protected by vegetation and holds potential for *Clemmys insculpta*. In addition to *Emydoidea*, the NSWA produced the following species: *Chrysemys picta*, *Rana clamitans*, *Rana sylvatica*, *Hyla versicolor/chrysoscelis*, *Thamnophis sirtalis*, *Chelydra serpentina*, and *Bufo americanus*.

NEW HOPE PINES (NEH 18): This site was visited once (2 person hours). The site exhibits good herp diversity with *Rana clamitans*, *Chrysemys picta*, *Plethodon cinereus*, and *Hyla versicolor/chrysoscelis* all being documented during this single visit. During visits of previous years, *Ambystoma laterale* and *Notophthalmus viridescens* were also encountered at the edge of a pot-hole pond. No *Hemidactylum*, *Emydoidea*, or *Clemmys* were encountered but additional work is recommended.

POYGAN MARSH STATE WILDLIFE AREA (SGP 03): A two brief visits were made to this site (2 person hours). *Rana clamitans*, *Rana pipiens*, and *Thamnophis sirtalis* were all that were encountered.

WHITE LAKE (NEP 02): A brief visit was made to the public boat landing of this lake with no herps being observed.

WOLF RIVER STATE WILDLIFE AREA (SGP 01): A brief visit was made to a marsh at this site (1 person hour). A large population of *Rana pipiens* was observed. More work needs to be done at this site.

Wisconsin Natural Heritage Program Element Occurrence Records

The following localities were provided from the Wisconsin Natural Heritage Program Element Occurrence Records or were read off a map provided by NHI. Element Occurrence Records were not provided for all map localities, so the precise location of some of the mapped sites was uncertain. Nineteen of the 31 sites were visited (61%) with five confirmations. Seventeen new rare herp records were added.

NHI 006 Diadophis punctatus, NHI 035, 036 Hemidactylum scutatum: All three localities in same general area. Large sphagnum bog deep in forest (Herp 80) produced two *H. scutatum*, each with a nest and in same raised sphagnum hummock over open water (ERW 1307-08). *Rana sylvatica* was also observed, but the presence of *D. punctatus* was not confirmed.

NHI 007 Diadophis punctatus: Visited public boat landing for Lake Lucerne (1 person hour) and found nothing.

NHI 023 Rana catesbeiana: Public landing for Little Rice Lake just above spillway produced a *Chrysemys picta* above, and *Rana clamitans* (UWSP 1305-06) downstream at Old Hwy 8 bridge (1.5 person hours). No *Rana catesbeiana* were observed.

NHI 026 Emydoidea blandingii: Two visits to this site (3.5 person hours) in the Navarino State Wildlife Area confirmed the presence of *E. blandingii*, and also documented *Chrysemys picta*, *Rana clamitans*, and *Chelydra serpentina*.

NHI 033 Ophisaurus attenuatus: Brief visit to site could not confirm the presence of *O. attenuatus*.

NHI 040 Emydoidea blandingii: Not visited

NHI 041 Emydoidea blandingii: Inspected the site from car, chose not to investigate.

NHI 043 Ophisaurus attenuatus: Brief visit to site could not confirm the presence of *O. attenuatus*.

NHI 060 Clemmys insculpta: Visited sphagnum bog in Langlade County Forest Croplands (2.5 person hours). Did not confirm presence of *C. insculpta*, but found nest of *Hemidactylum scutatum* (Herp 79) by the presence of a nest with 42 eggs in sphagnum hummock hanging over open water puddle created by treefall. Also present in bog was *Rana sylvatica* (UWSP 1304)

NHI 086 Acris creptians: Inspected Maple Creek from Hwy 45 (0.5 person hours) but

did not venture onto private lands. The presence of *Acris crepitans* was not confirmed, but the stream holds potential for *Clemmys insculpta*.

NHI 086 *Clemmys insculpta*: Not visited.

NHI 087 *Acris crepitans*: Not visited.

NHI 108 *Clemmys insculpta*: A stop by visit to Cty A bridge over Hennig Creek did not confirm the presence of *C. insculpta*. However Hennig Creek is a quick flowing, clear stream surrounded by dense alder thicket that shows great *Clemmys* potential. Access was limited so the stream was not worked.

NHI 121 *Clemmys insculpta*: Not visited.

NHI 121 *Emydoidea blandingii*: Not visited.

NHI 122 *Emydoidea blandingii*: A road-kill *Emydoidea blandingii* found on Shawano Cty K on 6 June (UWSP 3802) and another on 8 June (UWSP 3810) just 10 meters from the first, confirm the continued presence of this species in the area. Both these localities are on Cty K as it passes through Navarino State Wildlife Area.

NHI 123 *Emydoidea blandingii*: Approximately 20 person hours were spent in the Navarino State Wildlife Area including working trails that pass near this locality. The occurrence of *E. blandingii* in the area was confirmed near this site as well as elsewhere in NSWA (Herp 77 *Emydoidea blandingii*; Herp 82-83 *E. blandingii*). Also encountered within NSWA were *Thamnophis sirtalis*, *Chelydra serpentina*, *Chrysemys picta* (UWSP 3812-13), *Rana sylvatica* (Herp 85), and *Hyla chrysoscelis/versicolor*.

NHI 125 *Clemmys insculpta*: Not visited.

NHI 124 *Emydoidea blandingii*: A brief drive-by visit did not confirm the presence of *E. blandingii* in the area, but the exact locality was not clear.

NHI 127 *Clemmys insculpta*: A section of the Pigeon River above and below Knitt Rd was waded (2 person hours) but the presence of *C. insculpta* could not be confirmed. The stream, however, holds high potential for the occurrence of this species. Other species encountered include *Chelydra serpentina*, *Chrysemys picta*, and *Rana clamitans*.

NHI 140 *Clemmys insculpta*: Not visited.

NHI 141 *Clemmys insculpta*: Not visited.

NHI 148 *Clemmys insculpta*: Not visited.

NHI 149 *Clemmys insculpta*: Not visited.

NHI 152 *Clemmys insculpta*: Not visited.

NHI 155 *Clemmys insculpta*: The entire shore of School Section Lake was explored by canoe, and the creek that drains into the lake was waded upstream for ~1 mile (7 person hours) with no observations of *Clemmys insculpta*. *Chrysemys picta* and *Rana clamitans* were observed in the lake. The limited size and length of the stream flowing into the lake suggest that if *C. insculpta* are indeed present, the population is likely small and isolated.

NHI 187 *Emydoidea blandingii*: Not visited.

NHI 190 *Emydoidea blandingii*: Not visited.

NHI 197 *Clemmys insculpta*: This locality, near a boat landing at Cty CCC bridge over the Wolf River, produced *Chrysemys picta* and *Rana clamitans* along bank of river but did not confirm the presence of *C. insculpta* (1.5 person hours).

Wolf and Little Wolf Rivers

The primary objectives of river work was to document turtle species by observation of basking individuals, and to mark potential nesting sites. The Little Wolf River was worked downstream by canoe and the Wolf River was worked by motor boat.

LITTLE WOLF RIVER: An approximately 8 mile stretch of the Little Wolf River was canoed from the landing at the junction of Cty B and BB to Cty X (9 person hours). Some *Graptemys geographica* were seen basking on

emergent rocks, but a strong storm moved in so that only potential nesting sites were marked (Herp 99-108). This section of the stream holds high potential for *Clemmys insculpta* and should be surveyed further. The clear, shallow, fast flowing water with numerous basking sites and sufficient sandy banks make this ideal habitat for *C. insculpta*.

Permission was granted to visit a private land trust with river frontage ~1 miles upstream from Big Falls. No observations of herps were made, but the site holds great potential. The trust is very interested in herpetological survey work in order to properly care for the herpetofauna.

WOLF RIVER North from Shiocton: The Wolf River was worked by boat north from Shiocton to approximately 1 mile upstream from Koepke Park (12 person hours). Numerous potential nesting sites including sand bars, banks, and washes were marked (Herp 109-122). Few turtles were seen basking, all appeared to be *Graptemys geographica*. A predated, active nesting site was discovered (Herp 120) at a sharp bend in the river where erosion had cut into a high bank. Two kinds of eggs were present, one *Chelydra serpentina* the other unknown (UWSP 3824-26). Across the river was a large exposed sand bar with turtle tracks and a *Rana pipiens*. *Rana pipiens* were also common at Koepke Park Landing. This stretch of the river seems to have lower potential for *Clemmys insculpta*. The river is deep, slow moving, not clear, and much of the bank has been modified including development and rock rip-rap.

Further northward, at the public boat landing at the junction of the Wolf River and Hwy 156, several *Chrysemys picta* and *Apalone spinifera* (UWSP 3803) were basking in floating vegetation of the backwater bay.

WOLF RIVER Shiocton south to New London: The Wolf River was worked by boat downstream from Shiocton to New London (28 person hours). Few basking turtles were seen and these were *Graptemys geographica* or *Chrysemys picta*. A few sand banks, bars, or washouts were marked as potential nesting sites (Herp 92-98). This stretch of the river seems to have lower potential for *Clemmys insculpta*. The river is deep, slow moving, not clear, and much of the bank has been modified including development and rock rip-rap.

General Overview of Herp Community

Nineteen species of reptiles and amphibians were observed in the Wolf River GMU during the study period (Table 2). This represents, 49% of the species otherwise known or expected to occur in the Wolf River GMU (Casper, 1999; Vogt, 1981). This total includes nine species of amphibians (six anurans, three salamanders) and ten species of reptiles (six turtles, four snakes). Three species of “rare” herps were recorded from the Wolf River GMU: the Endangered *Acris crepitans*, the threatened *Emydoidea blandingii*, and the Special Concern *Hemidactylium scutatum*. One new county record was established with *Lampropeltis triangulum* in Portage County with a specimen that was collected previous to the study period. The seemingly low percentage of the expected fauna encountered in this study can be attributed to limited sampling time and sampling bias (the primary objective was not to perform a comprehensive survey), combined with seasonal and climatic factors. Sampling was not performed in order to rigorously determine abundance over the entire GMU, nor within any subdivisions thereof. In this study, relative abundance is only useful within a particular site, and provides a baseline for future comparisons. Therefore, relative abundance of the herp species of the Wolf River GMU can only be discussed qualitatively and cautiously. Most of the species and abundances encountered are what one would have predicted for a natural herpetofauna in the region.

Species Not Encountered

Several species of the expected herpetofauna of the Wolf River GMU were not encountered during the study. This is not to say they do not occur there and caution should be employed when considering the negative data of this study. Several factors can explain the absence of expected species from our data. Sampling timing was not ideal and sampling effort was clearly biased in favor of *Clemmys*, *Emydoidea*, and *Hemidactylium*.

1. Sampling Time: Although the amount of time spent surveying the Wolf River GMU was limited by resources, there is a much more limiting factor to this survey, time of year. As poikilotherms, reptiles and amphibians are notoriously seasonal animals. Searches during other times of the year would certainly improve the data set. Early spring is an essential period of time for accurately assessing a herpetofauna. Amphibians call,

migrate, and congregate early in the spring, which makes them more easy to find. For example, *Pseudacris crucifer* and *P. triseriata*, are certainly located within the Wolf River GMU although none were seen. These diminutive frogs are vociferous in the spring, but very difficult to find later in the year. Likewise, *Ambystoma maculatum* and *A. tigrinum* should be present within the Wolf River GMU. These salamanders congregate in temporary ponds for mating in early spring, after which they disappear below ground, requiring extensive work and chance to find them.

2. Sampling Bias: Sampling effort targeting *Clemmys*, *Emydoidea*, and *Hemidactylum* biased the data against several other herps. Additional effort needs to be made in small lakes and ponds in order to document *Emydoidea* and in small streams and the Little Wolf for *Clemmys insculpta*. Active searches in more xeric, open habitats should reveal several of the species typically common in northern Wisconsin (*Elaphe vulpina*, *Diadophis punctatus*, *Heterodon platyrhinos*, *Lampropeltis triangulum*, *Storeria dekayi*) and for long-term study artificial cover boards could be used. Shoreline habitat along the main rivers, lakes, and streams should be given close inspection for *Nerodia sipedon*. Netting by hand in forest pools and swamps, and by seine in rivers should produce *Notophthalmus viridescens* and *Necturus maculosus* respectively.

Table 2. Amphibians and reptiles documented or expected to occur in the Wolf

River GMU (Casper, 1999). √ = recorded by this survey in the WR-GMU; E = Endangered, T = Threatened, SC = Special Concern.	
AMPHIBIANS	REPTILES
Ambystomatidae	Chelydridae
√ Ambystoma laterale	√ Chelydra serpentina
Ambystoma maculatum	Emydidae
<i>Ambystoma tigrinum</i>	√ Chrysemys picta
Plethodontidae	<i>Clemmys insculpta</i> (T)
√ Hemidactylum scutatum (SC)	√ Emydoidea blandingii (T)
√ Plethodon cinereus	√ <i>Graptemys geographica</i>
Proteidae	<i>Graptemys pseudogeographica</i>
Necturus maculosus	Kinosternidae
Salamandridae	√ <i>Sternotherus odoratus</i>
<i>Notophthalmus viridescens</i>	Trionychidae
Bufonidae	√ <i>Apalone spinifera</i>
√ <i>Bufo americanus</i>	Colubridae
Hylidae	Coluber constrictor (SC)
√ <i>Acris crepitans</i> (E)	Diadophis punctatus (SC)
√ <i>Hyla versicolor/chrysoscelis</i>	√ Elaphe vulpina
Pseudacris crucifer	<i>Heterodon platyrhinos</i>
<i>Pseudacris triseriata</i>	√ <i>Lampropeltis triangulum</i>
Ranidae	<i>Nerodia sipedon</i>
Rana catesbeiana (SC)	<i>Opheodrys vernalis</i>
√ Rana clamitans	<i>Storeria dekayi</i>
<i>Rana palustris</i>	√ <i>Storeria occipitomaculata</i>
	√ Thamnophis sirtalis

✓ *Rana pipiens*
Rana septentrionalis
✓ *Rana sylvatica*

Scincidae

Eumeces fasciatus

Eumeces septentrionalis

Anguidae

Ophisaurus attenuatus (E)

Turtles

Among the turtles none were ubiquitous throughout the Wolf River GMU. The various species exhibited habitat preferences already documented (Vogt, 1981). Of the four species of turtles observed, their relative abundance of observation (not considering nests) in decreasing order was approximately: *Chrysemys picta* > *Graptemys geographica* > *Emydoidea blandingii* > *Chelydra serpentina* = *Apalone spinifera* > *Sternotherus odoratus*.

CHRYSEMYS PICTA was the most frequently encountered turtle throughout the Wolf River GMU. Turtles were observed from Forest County in the north (ca. NHI 023) to Waupaca County in the south. These turtles were observed in all types of aquatic habitats, but less frequently in the main river-ways and small streams. In spite of tremendous road-kill mortality, *Chrysemys picta* remain common.

GRAPTEMYS GEOGRAPHICA was commonly found basking on emergent tree snags or lowly hanging branches over the water of the Little Wolf and Wolf Rivers. In these main rivers, this species is more common than *Chrysemys picta*, but is less common in still water lakes. *Graptemys* was also frequently encountered in the Waupaca Chain O' Lakes, but here every individual had deep scars, fissures, or lacerations to the shell, apparently from boat propellers. I anticipate that *Graptemys geographica* will not be a resident species of the Chain O' Lakes for long. The habit of these species to sit amongst the bottom muck or forage in shallow areas makes them particularly vulnerable to the heavy boat traffic on these lakes. This problem needs immediate attention if *Graptemys* is to thrive in the Chain.

EMYDOIDEA BLANDINGII (Threatened) was commonly found throughout the study area. Individuals were found basking in marshes or hiking across roads, but most individuals were found as road-kill. The frequency with which these turtles were encountered indicates that they have healthy populations in some areas of the Wolf River GMU such as Navarino State Wildlife Area. It seems that movement to nesting sites is the danger for these turtles, and if these routes and/or nesting sites can be identified then protective measures can be taken. Further work to identify *Emydoidea blandingii* nesting sites is needed.

CHELYDRA SERPENTINA was not commonly seen, but these are typically secretive aquatic turtles. A new-born and a large adult were found along the Pigeon River. In Navarino State Wildlife Area numerous predated *Chelydra* nests were found on the dike of Waltrach Flowage and a young turtle on the edge of a gravel road at the southern edge of the area.

APALONE SPINIFERA was observed at one location, a backwater of the Wolf River (Herp 78) where at least two were laying on a thick mat of vegetation in the water. Many small *Chrysemys* were present as well. These turtles are probably more common than this study indicates. They are extremely wary and are quick to dive in the water when disturbed and easily missed unless they are being looked for. These turtles prefer larger streams with muddy banks, and these areas were not emphasized by this survey.

STERNOTHERUS ODORATUS is not common in the Wolf River GMU. One individual was found as a road kill near the Waupaca Chain O' Lakes. These turtles are apparently common locally in the chain, but not elsewhere in the Wolf River GMU. This represents the northwestern extreme of their range, and may be

isolated. The health of the population of *Sternotherus* in the Waupaca Chain should be established in future studies.

Snakes

Four species of snakes were encountered. This low number is a bit surprising considering the effort at active search under logs and debris, however the time of year and weather was not ideal and emphasis was placed on wetlands. Relative abundance of observations: *Thamnophis sirtalis* > *Storeria occipitomaculata* = *Elaphe vulpina* = *Lampropeltis triangulum*.

THAMNOPHIS SIRTALIS was the most commonly encountered snake in the Wolf River GMU. This species was found in Navarino SWA, Mosquito Hill SWA, Poygan Marsh SWA, and numerous road kills throughout the GMU.

STORERIA OCCIPITOMACULATA was found on one occasion (Herp 86) and was found as a road kill. Effort was not made to document this species so this low number is not surprising. They are likely quite common.

ELAPHE VULPINA was encountered once. A large individual was found dead on Hwy 54 as a road kill, just east of Royalton.

LAMPROPELTIS TRIANGULUM was previously unrecorded from Portage County. A person brought a dead and decapitated specimen to my office in May, 2000. The individual was reliable and the specific locality, in far eastern Portage County, was reasonable. As far as I can determine, this is the first record of *L. triangulum* in Portage County.

Salamanders

Three species of salamanders were observed: *Ambystoma laterale* > *Plethodon cinereus* > *Hemidactylium scutatum*. None of these species were very commonly encountered; they were usually found incidental to searches for the elusive *Hemidactylium scutatum*. Several sites were worked particularly hard for *Hemidactylium*, producing two localities.

AMBYSTOMA LATERALE is probably a very common salamander in the GMU where there is moist forest and small ponds. *Ambystoma laterale* was observed in Maine SWA, Mosquito Hill, and Mud Lake Forest Headwaters SWA.

PLETHODON CINEAREUS was occasionally observed, but efforts to find this forest species were not made. Nonetheless, specimens were observed in Maine SWA, Mud Lake Forest Headwaters SWA, and New Hope Pines.

HEMIDACTYLIUM SCUTATUM was documented at two northern sites, both close to two previous records (NHI 035-036). At one site (Herp 79) in Langlade County Forest Croplands a nest was found in a sphagnum bog. The nest was ~4" deep into a sphagnum hummock overhanging a small pool of water that had formed when a tree was uprooted. The nest had 42 eggs in one mass. At one moment I thought I saw a tail of a salamander disappear into the sphagnum but I could not find it to verify the observation. The second site was deep in the woods of Forest County (Herp 80). We explored a large (50 acre) sphagnum bog, and I found two nests ~4" deep in a sphagnum hummock overhanging a bit of open water. The hummock was near the base of a Tamarack tree. The two nests were just 5-6" apart. An adult individual was associated with each nest. One nest had about ten eggs, the other about 52.

Similar sampling efforts in other sphagnum habitats (Mud Lake Forest Headwaters, Hortonville Bog) surprisingly did not produce any more observations of this species. The status of *Hemidactylum* remains somewhat of a mystery, and continues to warrant the Special Concern status as more targeted survey work is needed for this species.

Frogs & Toads

Six species of anurans were encountered during the study period. Anurans have the advantage of being able to determine their presence by call as well as by visual observation; this aided in documenting at least one species (*Hyla versicolor/chrysoscelis*). However, the study period did not correspond to the breeding (and thus calling) period for many of the anuran species in the Wolf River GMU. Most of the anuran observations were obtained while working lakes or streams for turtles, or bogs for *Hemidactylum*. Relative abundance of observations: *Rana clamitans* > *Rana sylvatica* > *Hyla versicolor/chrysoscelis* > *Bufo americanus* > *Rana pipiens* > *Acris crepitans*.

RANA CLAMITANS was nearly ubiquitous in the Wolf River GMU, and was the most abundant frog observed. This species was observed on lakeshores, in small streams, and in marshes. Closer investigation is necessary to identify the habitat preferences of this species as they seem to be a true generalist.

RANA SYLVATICA was a very abundant frog encountered throughout the Wolf River GMU where there were forested habitats. *Rana sylvatica* was also frequently found in association with sphagnum bogs (e.g., Mud Lake Forest Headwaters SWA) as well as marshes (Navarino SWA) and other types of wetlands.

HYLA CHRYSOSCELIS/VERSICOLOR was rarely visually observed, but the calls of this species complex could be heard near most of the still bodies of water with trees near it such as the stream of Navarino SWA (Herp 85), and Maine State Wildlife Area.

BUFO AMERICANUS was frequently observed but usually only as an isolated individual. Little effort was made in looking for this more terrestrial anuran.

RANA PAPIENS were not commonly observed, but when they were found, they were usually abundant. One individual was observed on a sandbar of the Wolf River in the Outagamie Wildlife Area upstream from Koepke Park (Herp 120). Five individuals were captured and several others observed in the marsh of the Wolf River State Wildlife Area. *Rana pipiens* was also observed in the Poygan Marsh State Wildlife Area. This species seems to have a spotty distribution throughout the Wolf River GMU, preferring more marsh-like habitats or growths of emergent vegetation along lakeshores.

ACRIS CREPITANS was previously considered extinct from the greater portion of its range in Wisconsin (Hay XXX). Therefore, it was the most exciting find of this survey to discover an individual in the Chain O' Lakes of Waupaca County. Waupaca County was previously considered the northern extreme of this species range. The single frog was heard calling on 10 June. It continued to call intermittently for about one hour as we attempted to move closer. I had visual identification of the frog twice from just two feet away. Once I tried to grab it but it escaped. I continued to visit the site in the late evening and found the frog calling: 19 June 18:30-19:15; 25 June 18:00; 26 June 16:00-18:00; 5 July 16:30-19:00; 10 July 16:37; 11 July 17:48; and 17 July in the evening. The frog was recorded during the 26 June visit and a copy of the call was forwarded to Robert Hay (BER Cold Blooded Specialist) and the original kept in the Audio Collection of the Herpetology Collection of the Museum of Natural History, UWSP.

The habitat consisted of a soft mud flat that jutted out from a point that borders a channel to another lake. The site is 30 feet away from a public boat landing and is directly offshore of private land. The mud flat had small puddles of water between clusters of Water Willow (*Decodon verticillatus*; Robert Freckmann personal communication, UWSP). Later in the year Purple Loosetrife invaded the mud flat and then it

was sprayed with Roundup as is typically done on the Chain O' Lakes. It was about this time that the frog stopped calling.

It is possible that this frog was a single individual released by a fisherman at the boat landing. Numerous fishermen from Illinois visit the lakes during the summer, and *Acris* remains common in Illinois. The proximity to the boat landing and the presence of a single individual support this hypothesis.

Nonetheless, the frog managed to exist at the locality for over a month.

Acris typically prefer muddy banks on larger bodies of water. Many such sites, as with this one, have become invaded with Purple Loosestrife. Either the chemical treatment or the habitat alteration by this invading species may be related to the disappearance of this frog from the state. Further research investigating the correlation of this invasion and the disappearance of *Acris* would be insightful, as well as studies elsewhere where the two species co-occur. More immediately it is imperative that the occurrence of this species be checked again in spring.

Management & Protection Recommendations

To discuss management and protection needs of the herpetofauna in the Wolf River GMU, threats and problems need to be identified first. The Wolf River GMU is a trying place to be a herp unless one is fortunate enough to be in one of the state's protected areas. The landscape is highly fragmented and wetlands heavily used. Bogs are few and isolated, but undisturbed where they occur. There are many threats to the herpetofauna in general, and the rare herps in particular, throughout the Wolf River GMU.

ROADWAYS & AUTOMOBILE TRAFFIC: There was tremendous turtle and snake mortality on roadways throughout the GMU and during the entire study period. Most of our records for *Emydoidea blandingii* are from road-kills. Such threats are not limited to the main highways. Even a county road that passes through a state wildlife area such as County K through Navarino SWA has the potential to be a deadly corridor for herps, especially if they are used as detours for busy highways, as County K was in this case. Some kind of environmental impact assessment should be made before rural roads are designated detour routes.

Perhaps constraints on traffic alternatives need to be explored. This could be for certain types of vehicles (e.g., semi-trucks) and could apply to only rural roads. Another possibility is the identification of specific nesting sites and migration routes so that alternate pathways for the organisms can be constructed (tunnels etc.) or better yet, that the roadway can be removed. Identifying the specific time period for migrations will allow the closing of roads or sections of roads during prime migration time. This could be even for a very short period, as little as one night in the case of many amphibians. All these measures, however, will not eliminate the devastation of herps on the roads, but it should help.

WETLAND MODIFICATION & RECREATIONAL USAGE: As a result of the field work, two severe problems for herps on the Wolf River emerged: boat traffic and shoreline alteration. The Wolf River is heavily traveled with boats frequently travelling at high speeds. Turtles likely suffer stress from repeatedly being frightened from their basking logs (an essential nutritional behavior) and may even suffer direct injury from being hit by these boats. The wake from these vehicles alters shoreline microhabitats that are important for many amphibious herps, for that is the location where their terrestrial habitat meets their aquatic habitat. This is a severe problem on the Waupaca Chain O' Lakes where in this last summer I found three *Graptemys* with severely scarred, broken, or lacerated shells. These shallow muck-bottomed lakes with their narrow channels from one lake to the next leave a turtle without escape from the boats that pass by.

Even more troubling to me was the extent of direct shoreline alteration by man. Specifically, the use of rock, concrete, brick, or other solid debris as rip-rap along the shore. I suspect that this is used to prevent erosion and to favor fish spawning, but it severely modifies the river habitat in a way that is detrimental to many herps. In areas of this rip-rap there is no vegetation, no soft ground for nesting, and no erosion. Most herps could not negotiate the steep hard banks to even get out of the water to carry out their activities on land. A river following its natural course of evolution erodes banks away and creates new banks at the

same time. These eroded banks are the critical sites for turtle nesting. Using rip-rap to deter erosion forces the river to form a channel, thus eliminating shallow shoreline microhabitats such as backwater pools, eddies, and marsh. I suspect that long stretches of the river are herpetologically sterile due to the use of this rip-rap. Preservation and restoration of natural erosion processes would benefit many of the native herp species.

The introduced Purple Loosestrife may have a negative impact on herp species through the modification of critical habitat in many wetlands. This seems possible in the case of *Acris crepitans*. I am not sure, however, that chemical treatment of purple loosestrife is any better than no treatment at all. It eliminates the invader, but the impact to tadpoles developing in pockets of water directly below where the chemical is being sprayed is unknown.

DEVELOPMENT & HABITAT FRAGMENTATION: There is extensive development throughout the Wolf River GMU. This development fragments habitats. Large mammals may be able to move from one fragment to another fragment easily, but these are formidable barriers for herps. With herps isolated into small fragments and small populations, there is insufficient opportunity for the natural migration of individuals from fragment to fragment. This is particularly true for some of the land-locked wildlife areas. Riverfront development and the inevitable lawns, chemicals, pets, and shoreline modification that accompany it are additional problems for herps that I foresee becoming worse into the future.

WETLAND LOSS & AGRICULTURE: The agriculture lands that dominate our rural landscape also contribute to its fragmentation and pollution. Many farms use every last inch of property right-up to the edge of a wetland, leaving it isolated and unbuffered. This is true for other types of development as well. So much of the landscape is agriculture, that changes in agriculture practices could have far reaching positive effects on the surrounding herpetofauna. Leaving unplowed areas in addition to wetlands is one possibility.

Future Inventory

With the groundwork laid by this survey, future field work can be done more efficiently. The most important need of future work is documentation of breeding and actual turtle nesting sites earlier in the spring. *Clemmys insculpta* is secretive and terrestrial for much of the summer after mating in April–May, and laying eggs in early June (Vogt, 1981). Likewise, *Emydoidea blandingii* breed in April–May and lay eggs in early June. It is during these periods of time that these turtles are conspicuous, especially females as they venture to nesting sites and can frequently be found crossing roads. During this time period all the actual and potential nesting sites identified from this survey should be visited repeatedly. Efforts should be made to document proximity of roadways to migration routes so that problem localities can be managed.

Once nesting sites are identified, information is needed on the cause and impact of nest predation on turtles, especially *Clemmys* and *Emydoidea*. This could involve collection and identification of scat, and the trapping and population study of predators. First, however, population assessments need to be made on these turtles. The whole Wolf River GMU is not a single turtle population, at least it shouldn't be for management concerns. More localized units or gene pools need to be recognized. How many populations are there? What are the population ranges? What is the degree of migration among populations?

Furthermore, intense efforts should be made to work by foot the smaller creeks that flow into all parts of the Wolf River in order to document the distribution of *Clemmys insculpta*. Likewise, more effort needs to be made to search still wetlands and small lakes for *Emydoidea* than was done this year; the use of hoop-nets may work better for the more aquatic *Emydoidea* than for *Clemmys*.

Early spring visits would also benefit collecting data on species of amphibians (e.g., *Ambystoma maculatum*, *A. tigrinum*). The elusive *Hemidactylium scutatum* lays eggs in late April–early May (Vogt,

1981), and the bogs sites (Herp 12, 14) should be visited again during this time. Many of the anurans call during this early spring period as well (i.e., *Pseudacris triseriata*, *P. crucifer*), which would make it easy to perform call surveys for many sites. Dip netting and seines in streams and temporary pools would capture salamanders and their larvae.

Little data were collected on snakes in the Wolf River GMU. Although few snakes were identified as of concern in the NHI Working List, additional efforts to sample more open, xeric areas could be made. Long-term data on snakes could easily be obtained by using artificial cover objects such as sheet metal or plywood. Snakes use these cover objects as natural cover, and so they can be left in the field year after year and checked when convenient. Data on habitat, reproduction, distribution, and abundance could be obtained in this manner for a minimal initial investment into a couple hundred boards.

Little effort was made to document the presence of *Ophisaurus attenuatus*. This important species is located in the southernmost edge of the Wolf River GMU and priority was not made to visit this area until too late. Future surveys should be sure to make an effort at documenting this species. Lastly, future efforts may just want to focus on one of the ecological landscapes at a time. This would make it easier to summarize data in a ecological significant context, something that was not done this year.

Data collection methods should remain the same as this year with slight modification. Future efforts should continue to keep track of time in the field, but it would be useful to be able to break it down according to search method and habitat type to better standardize effort, which was not done this year.

LITERATURE CITED

- Casper, G. S. 1999. Wisconsin Herp Atlas Newsletter: 1999 Reporting Package. Milwaukee Public Museum, Milwaukee, Wisconsin.
- Epstein, E., W. Smith, and A. Galvin. 2000. Biotic Inventory & Analysis of the Wolf River Basin: An Interim Report of the Natural Communities, Rare Plants and Animals, Aquatic Invertebrates, and Other Selected Features. March 13, 2000. Wisconsin's Natural Heritage Inventory Program, BER, WDNR.
- Vogt, R. C. 1981. Natural History of Amphibians and Reptiles in Wisconsin. Milwaukee Public Museum, Milwaukee, Wisconsin.

